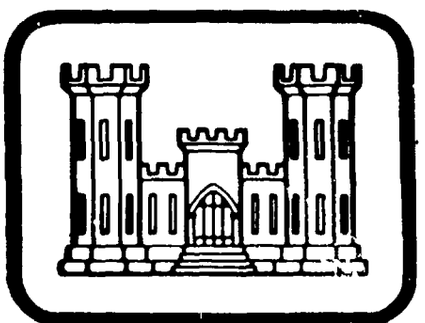
SUSQUEHANNA RIVER BASIN
LAKE STRAUSE DAM
LAKE STRAUSE INCORPORATED

NDI NO. PA-01010
DER NO. 38-068

LEBANON COUNTY, PENNSYLVANIA
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DACW31-81-C-0013

PREPARED FOR

DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

Baltimore, Maryland 21203

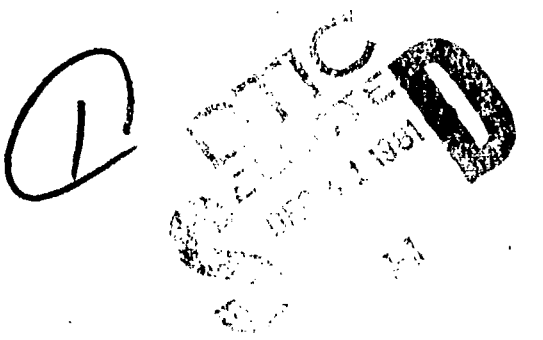
Hendrik Jongsma

BY

Berger Associates

Harrisburg, Pennsylvania 17105

JULY 1981



PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam:	LAKE STRAUSE DAM
State & State No.:	PENNSYLVANIA, 38-068
County:	LEBANON
Stream:	MONROE CREEK
Date of Inspection:	JUNE 15, 1981

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in good condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is significant. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). The recommended SDF for this structure is the 100 year flood. The spillway capacity is insufficient for passing the SDF peak inflow without overtopping the dam. The spillway, therefore, is considered to be inadequate.

The following recommendations are presented for immediate action by the owner:

(1.) That provisions be made to increase the spillway capacity.

(2.) That the bare areas on the downstream slope be reseeded.

(3.) That the drop inlet structure be inspected for structural adequacy after the reservoir has been lowered.

(4.) That the struts in the spillway be removed and that the wooden waterway diversion poles be secured by other means.

(5.) That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.

LAKE STRAUSE DAM NDI NO. PA-01010 DER NO. 38-68

LAKE STRAUSE INC. LEBANON COUNTY

(6) That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: July 31, 1981

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER
No. 5537E

APPROVED BY:

James W. Peck
Colonel, Corps of Engineers
Commander and District Engineer

DATE: 7 Aug 81

OVERVIEW

LAKE STRAUSE DAM

Photograph No. 1

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE STRAUSE DAM

NDI NO. PA-01010
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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: Design drawings for Lake Strause Dam are not in existence. The U.S.G.S. Quadrangle sheet indicates a reservoir elevation 488.0. Photogrammetry recently prepared for flood studies in this area indicates the spillway elevation as Elev. 492.9. This elevation is used in this report as the spillway crest elevation.

Lake Strause Dam is an earthfill structure with an approximate total length of 475 feet and a maximum embankment height of about 14 feet. The crest of the dam is a paved roadway. A two-span bridge crosses the spillway, which is located near the left abutment. A drop inlet structure, which discharges through a 36-inch pipe, is located near the right abutment.

B. Location: Bethel Township, Lebanon County
U.S.G.S. Quadrangle - Fredericksburg, PA
Latitude 40°-28.9', Longitude 76°-27.4'
Appendix E, Plates I & II

D. Size Classification: Small: Height - 14 feet
Storage - 76 acre-feet

D. Hazard Classification: Significant (Refer to Section 3.1.E.)

E. Ownership: Lake Strause Inc.
Mrs. Grace H. Donmoyer, President
R.D. #1
Fredericksburg, Pennsylvania 17026

F. Purpose: Recreation and fire protection

G. Design and Construction History

Reports in the Pennsylvania Department of Environmental Resources (PennDER) files indicate that a dam existed on this site prior to 1921. This earthfill dam had a timber crib spillway near the right abutment. In 1921, the dam was rebuilt. This work was done without a permit. The first site visit by a representative of PennDER was made in 1931. Improvements to the embankment and the spillway were repeatedly requested by PennDER, and several changes and additions were made over the years. There are, however, no record drawings or descriptions of these changes.

H. Normal Operating Procedures

All inflow above normal pool elevation 492.9 is discharged through the spillway and the drop inlet structure. The reservoir can be lowered for maintenance work on the beaches by opening the slide gate on the drop inlet structure.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	3.2
Computed for this report:	3.07
Use:	3.07

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations.

Maximum known flood (estimated from gage records for nearby Reeds Creek)	1242
Outlet works at pool Elev. 492.9	91
Outlet works at low pool Elev. 488	50
North spillway capacity at pool Elev. 496.3 (low point of dam)	110
South spillway capacity at pool Elev. 496.3	364

Total spillway capacity at pool Elev. 496.3	474

C. Elevation (feet above mean sea level)

Top of dam (low point)	496.3
Top of dam (design crest)	Unknown
Spillway crest	492.9
Crest drop inlet structure	492.9
Upstream portal invert	484.3
Downstream portal invert (estimate)	484
Streambed at downstream toe of dam (estimate)	482

D. Reservoir (miles)

Length of normal pool (Elev. 492.9)	0.3
Length of maximum pool (Elev. 496.3)	0.4

E. Storage (acre-feet)

Spillway crest (Elev. 492.9)	30
Top of dam (Elev. 496.3)	76

F. Reservoir Surface (acres)

Spillway crest (Elev. 492.9)	10.4
Top of dam (Elev. 496.3)	16.7

G. Dam

Refer to Plates A-I and A-II in Appendix A for schematic plan and section.

Type:	Earthfill.
Length:	475 feet, including 24 foot spillway.
Height:	14 feet.
Top Width:	Design - unknown; Survey - 16 to 20 feet.

Side Slopes:		Design	Surveyed
	Upstream	Unknown	2.0H to 1V
	Downstream	Unknown	2.7H to 1V

Zoning: A concrete core wall has been reported in the left end of the embankment over an approximate length of 120 feet. Depth of wall is unknown.

Cutoff: Unknown.

Grouting: None.

H. Outlet Facilities

Type: 3 foot orifice in drop inlet structure with slide gate.

Invert Elevation: 484.3

Outlet: 3 foot diameter pipe.

Location: Upstream toe near right end of dam.

I. Spillway

North:

Type: Drop inlet structure, 3.7 feet wide x 4.5 feet long.

Crest Elevation: 492.9

Outlet: 36 inch diameter pipe.

Outlet Invert Elevation: 484.3

South:

Type: Broad crested weir with low flow diversion.

Crest Elevation: 492.9

Length of Weir: 21.5 feet.

Location: Near left abutment.

J. Regulating Outlets

See Section 1.3.H. above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Engineering design data for Lake Strause Dam do not exist. There are no indications that design drawings nor design calculations were prepared for the original design or for the modifications. The available information consists of inspection reports prepared by PennDER.

The first inspection occurred in October 1931. It appears that an existing dam was reconstructed in 1921 without obtaining a permit for construction. Prior to 1921, the dam had a timber crib spillway near the right abutment. The records indicate that in 1931 the right section of the dam consisted of a rock fill with a 118 foot long concrete core wall. The spillway near the left abutment was only 12 feet wide and 3 feet deep. The top of the concrete core wall was 21 inches above normal pool and could be used as an overflow section. The embankment was irregular in profile and width and overgrown with trees. Most of the normal inflow leaked through or under the core wall. A request was made to improve the spillway capacity and to repair the embankment. An inspection in July 1934 indicates that the leakage was stopped by placing concrete on the upstream side.

In March 1946, the spillway had not been improved and the embankment was still in poor condition. The reservoir was lowered five times between August 1948 and March 1958 to clean the shoreline and for weed control in the reservoir. A valve was installed on the drain pipe in September 1951.

The property was acquired in 1959 by the present corporation. Photographs indicate that the spillway at that time had been widened to the present dimensions and configuration. At that time, the bridge over the spillway consisted of a wooden deck on wooden timbers. Trees on the upstream slope were removed in 1959 and the leaking pipe, presumably the drain pipe near the right abutment, was replaced. The spillway was concreted in 1960. The drop inlet structure was reconstructed about 18 years ago. Requests for lowering the reservoir have been made six times in the 1970's for weed control in the reservoir and for cleaning of the shoreline.

2.2 CONSTRUCTION

Engineering data and records of construction or reconstruction for this dam do not exist.

2.3 OPERATION

Records of operation are not maintained by the owner. The owner's representative stated that the gate and chain on the drawdown facility were replaced in 1980. All inflow is discharged through the spillway and the drop inlet structure.

2.4 EVALUATION

A. Availability

Engineering design and construction data do not exist.

B. Adequacy

Because of the lack of engineering data, the assessment of the dam is based on the results of the visual inspection.

C. Operating Records

Operating records have not been maintained.

D. Post Construction Changes

Reference is made to Section 2.1 for a review of modifications made to these facilities.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Lake Strause Dam is good. The crest of the dam is wide and has a paved 16 foot roadway surface. The downstream slope is relatively flat and has been used to waste fill and tree cuttings. Many large size trees are on this slope. The spillway has a low flow diversion and is located near the left abutment. A drop inlet structure with a 36-inch diameter outlet pipe is located near the right abutment.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report. Photographs of the facilities taken during the inspection are reproduced in Appendix C.

Mrs. Donmoyer, president of the Lake Strause Inc., accompanied the inspectors on the day of inspection.

B. Embankment

The top of the upstream slope of the embankment is within three feet of the roadway edge. Most of the upstream slope is stone with some weeds and grass. There were no signs of wave action damage. Some sloughage close to the roadway edge has occurred near Station 3+50. This was caused by traffic (Photograph No. 2).

The crest of the dam consists of a 16 foot paved roadway (Photographs No. 3 and 4). The low point of the dam is at Station 4+50 where the crest is at least 30 feet wide and the embankment height is about four feet.

The downstream slope is irregular and has been used for dumping of fill and tree cuttings. Its surface is soft (uncompacted). There were no indications of seepage, slides, or sloughage. Many large diameter trees are located in this area. It could not be determined whether or not these trees are on the original slope or if they were beyond the toe and, due to the random filling, have become a part of the embankment.

C. Appurtenant Structures

The spillway is located near the left abutment and consists of a 24 foot wide, broad crested weir with a low flow diversion. This diversion was created by placing two pieces of telephone poles on the approach to the weir. The upstream side has a concrete approach to the top of the poles. Struts are placed against the bridge to support the

ends of the poles (Photograph No. 7). A two-span bridge with a center pier crosses the spillway. About 16 feet downstream of the bridge, the concrete discharge channel drops vertically 3.5 feet (Photograph No. 8), and from this point the channel is a rock lined channel. The concrete section, from the weir to the drop, is in fair condition with only minor deterioration.

The second outlet for this reservoir is a drop inlet structure located near the right abutment. The inside plan dimensions for this structure are 3.7 feet by 4.5 feet. Gratings are located over the opening (Photograph No. 5) and a handrail sits on top of the concrete walls. A 3.0 by 3.0 foot wooden gate located on the upstream side of the outlet structure can be opened to lower the reservoir level. According to the owner's representative, the chain to raise this gate and the gate were repaired in 1980. Water was flowing into the inlet at the time of inspection. Probing indicated that a concrete baffle wall is located over a part of the height. Inside horizontal steel framing was installed in 1980 to strengthen the structure. The outlet for this structure is a 36-inch concrete pipe (Photograph No. 6).

D. Reservoir Area

The slopes of the reservoir are mostly lawns and beaches on the right side and woodlands on the left side. The slopes are flat and apparently stable. Most of the drainage area is woodlands.

E. Downstream Channel

The immediate downstream channel is a natural stream with trees and brush on the slopes (Photographs No. 9 and 10). One house is located about 200 feet downstream of the embankment on the right bank (Photograph No. 10). There is a potential hazard for loss of a few lives downstream if the dam failed. The hazard category for Lake Strause Dam is therefore considered to be "Significant." Another reservoir, Lake Weiss, is located about 2000 feet downstream of Lake Strause Dam. The effect of failure of Lake Strause Dam on this downstream dam was not evaluated.

3.2 EVALUATION

The overall visual evaluation of the facilities indicates that Lake Strause Dam is in good condition. The upstream slope is mostly stone covered; the crest has a good bituminous roadway surface and is at least 16 feet wide. The trees on the downstream slope are apparently not rooted into the actual embankment, but into the fill and the original downstream soil.

The poles in the spillway should be secured by means other than the struts in order to reduce the chance of obstructing flow during high floods. It is recommended that the drop inlet structure be inspected for structural soundness the next time the reservoir is lowered.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Lake Strause Dam was constructed for recreational purposes, which are limited to fishing, boating, swimming, and ice skating. A normal pool level is desired for these functions. All inflow is discharged through the spillway and the drop inlet structure. The slide gate in this structure is opened occasionally to lower the reservoir level for maintenance.

4.2 MAINTENANCE OF EMBANKMENT

The embankment has a good appearance. Some bare areas on the downstream slope (Photograph No. 3) should be reseeded.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility is the gate on the drop inlet structure. This gate is used occasionally.

4.4 WARNING SYSTEM

There is no formally organized surveillance and downstream warning system in existence at the present time.

4.5 EVALUATION

The operational procedures for Lake Strause Dam are limited to mowing of the embankment. It is recommended that the maintenance of the dam include reseeding of bare areas on the embankment.

A formal surveillance plan and downstream warning system should be developed for implementation during periods of heavy or prolonged rainfall.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Lake Strause Dam was not very extensive. No area-capacity curve, frequency curve, unit hydrograph, design storm, design flood hydrograph, or flood routings were available.

B. Experience Data

There are no records of flood levels at Lake Strause Dam. Based on records of the U.S.G.S. stream gage on Reeds Creek at nearby Ono, Pennsylvania, the maximum inflow to Lake Strause Dam is estimated to have been 1242 cfs.

C. Visual Observations

It was noted that the wooden low flow diversion on the spillway was not secured tightly. The possibility exists that this device could break loose and obstruct the spillway.

It was also noted that there was a wall in the drop inlet structure. Water appeared to be ponding on the upstream side of this wall, indicating that either the opening through the wall was obstructed, or the size of the opening was less than the indicated 3 feet.

No other conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily until the dam is overtopped.

D. Overtopping Potential

Lake Strause Dam has a total storage capacity of 76 acre-feet and an overall height of 14 feet above streambed. These dimensions indicate a size classification of "Small." The hazard classification is "Significant" (see Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). Because of the small size of this dam and the small population downstream, the recommended SDF is the 100 year flood. For this dam, the SDF peak inflow is 1517 cfs.

Comparison of the estimated SDF peak inflow of 1517 cfs with the estimated total spillway discharge capacity of 474 cfs indicates that a potential for overtopping of the Lake Strause Dam exists.

E. Spillway Adequacy

Calculations show that the spillway discharge capacity, based on the present low point in the dam profile, cannot pass the SDF without overtopping (refer to Appendix D). The spillway, therefore, is considered to be inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 · STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of Lake Strause Dam did not detect any signs of sloughs, surface cracks or other indications of structural instability. Seepage was not noticed. The soft (elastic) condition on the downstream slope has been caused by dumping tree cuttings and uncompacted fill. This is not a recommended practice and should be discontinued. The slopes appear to be stable and adequate for the size of embankment under consideration.

2. Appurtenant Structures

The concrete, broad crested spillway appeared to be in good condition. The construction of the low flow diversion by placing the telephone poles does not affect the structural stability. The struts and loose poles could, however, restrict the waterway opening.

B. Design and Construction Data

Design and construction data are not available for review.

C. Operating Records

Operating records for this dam have not been maintained by the owner.

D. Post Construction Changes

Reference is made to Section 2.1 of this report for discussion of the origin and subsequent changes made to the embankment and its appurtenant structures.

E. Seismic Stability

This dam is located in Seismic Zone 1, and it is considered that the static stability is sufficient to withstand minor earthquake-induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection indicates that Lake Strause Dam is in good condition. The embankment appears to be stable. There were no indications of sloughs, slides, or seepage.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is significant. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). The recommended SDF for this structure is the 100 year flood.

The hydrologic and hydraulic computations indicate that the combination of storage capacity and the discharge of the spillways are insufficient to pass the 100 year flood without overtopping. The spillways are considered to be inadequate.

B. Adequacy of Information

The visual inspection is considered to be sufficiently adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

Additional studies are not required at this time if the recommendations are implemented immediately.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for immediate implementation by the owner:

1. That provisions be made to increase the spillway capacity.

2. That the bare areas on the downstream slopes be reseeded.

3. That the drop inlet structure be inspected for structural adequacy after the reservoir has been lowered.

4. That the struts in the spillway be removed and that the wooden waterway diversion poles be secured by other means.

5. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.

6. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A

CHECK LIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 38-68 NDI NO. PA-01010

NAME OF DAM Lake Strause Dam HAZARD CATEGORY Significant

TYPE OF DAM Earth embankment

LOCATION Bethel TOWNSHIP Lebanon COUNTY, PENNSYLVANIA

INSPECTION DATE 6/15/81 WEATHER cloudy TEMPERATURE 70's

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

H. Jongsma Wade Bell

R. Shireman Mrs. Donmoyer

A. Bartlett

NORMAL POOL ELEVATION: 492.9 AT TIME OF INSPECTION:

BREAST ELEVATION: 496.3 (Survey) POOL ELEVATION: 493.1

SPILLWAY ELEVATION: 492.9 (Aerial Survey) TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: Unknown

GENERAL COMMENTS:

This reservoir has a beautiful appearance. The upstream slope is short to the water's edge, has some weed growth, and some bare spots.

The crest of the embankment is a 16 foot wide paved roadway. The downstream slope is relatively flat and has been used to waste fill and tree cuttings in the past. This has provided a broad cross section for the embankment; however, the dumped material is not compacted. Mature trees are growing on the downstream slope about 20 feet from the roadway. A few are within five feet of the edge of the paved surface.

NDI NO. PA-01010

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None observed.
B. UNUSUAL MOVEMENT BEYOND TOE	None observed. Downstream slope is apparently extended due to past random filling.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None detectable on downstream slope due to past fill, brush, and mature trees. Upstream slope has several bare spots--not serious.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal - slight curve. Vertical - refer to Plate A-II.
E. RIPRAP FAILURES	No riprap observed.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Both junctions appear to be sound.
G. SEEPAGE	None detected.
H. DRAINS	None.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Crest - bituminous concrete road surface. Upstream slope - some weeds, grass, and stones. Downstream slope - grass, trees, and brush.

NDI NO. PA-01010

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Concrete drop inlet structure with wooden gate operated by hand wheel and winch near right end of abutment.
B. OUTLET STRUCTURE	36" pipe through embankment.
C. OUTLET CHANNEL	Small stream to main channel.
D. GATES	Wooden - 3' x 3'.
E. EMERGENCY GATE	Same as D.
F. OPERATION & CONTROL	Can lower water for clean up.
G. BRIDGE (ACCESS)	None - log extends from embankment to structure.

NDI NO. PA-01010

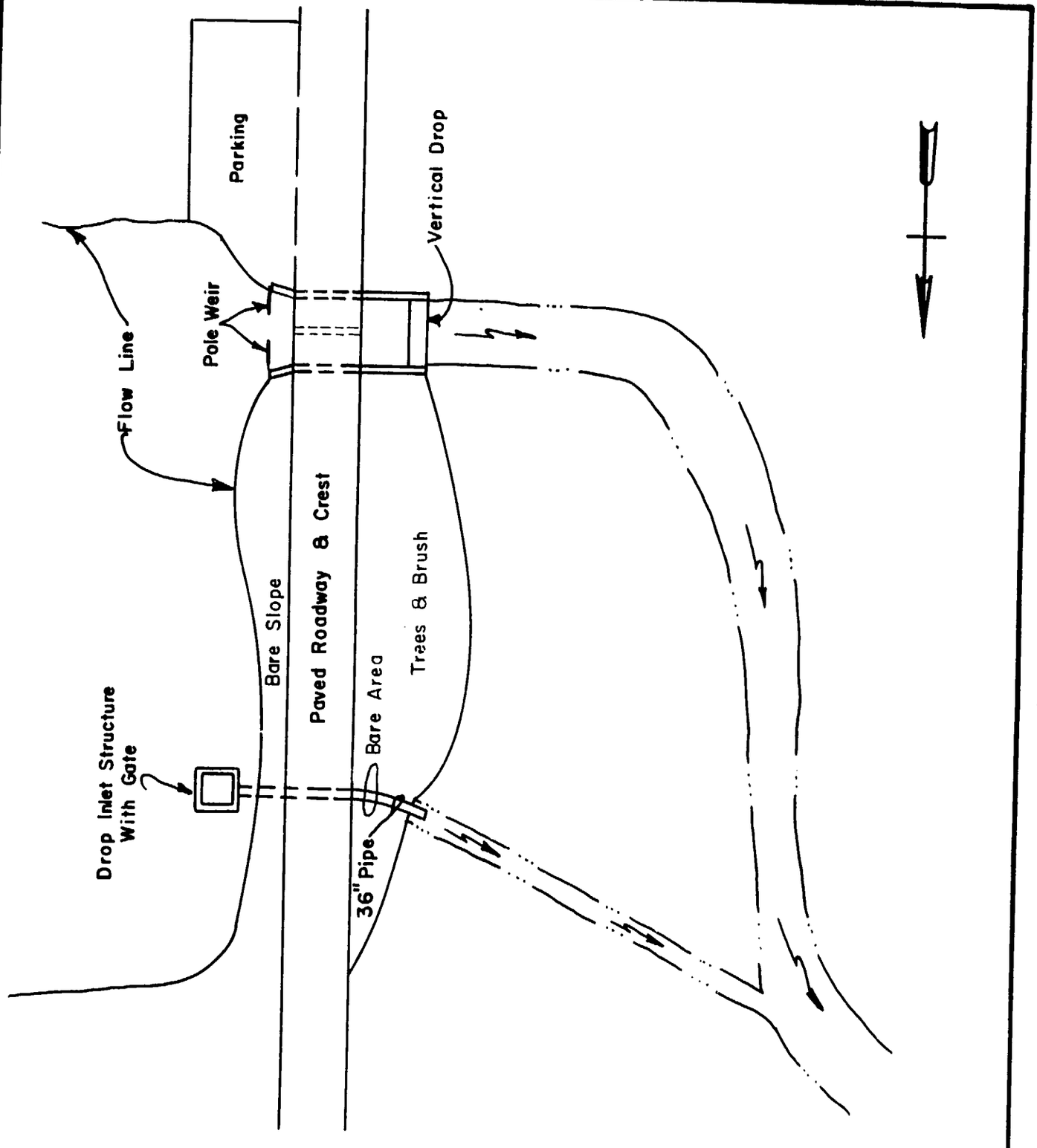
VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Approach is directly from the left side of the reservoir. Unobstructed.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Principal spillway is a wooden log forming a weir. It is protected at its ends with concrete and supported with wooden struts against the roadway bridge.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	The water flows over the weir, under the bridge, down a short concrete chute, then drops vertically to the outlet stream channel. There is no stilling basin.
D. BRIDGE & PIERS	Roadway bridge crosses spillway. Bridge has abutments and center pier.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	None.

NDI NO. PA-01010

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR	
Slopes	Lawns, beaches and trees.
Sedimentation	None reported.
Watershed Description	Mostly wooded.
DOWNSTREAM CHANNEL	
Condition	Natural stream.
Slopes	Wooded and brush.
Approximate Population	Few.
No. Homes	One reservoir 2000 feet downstream. One home below downstream toe.

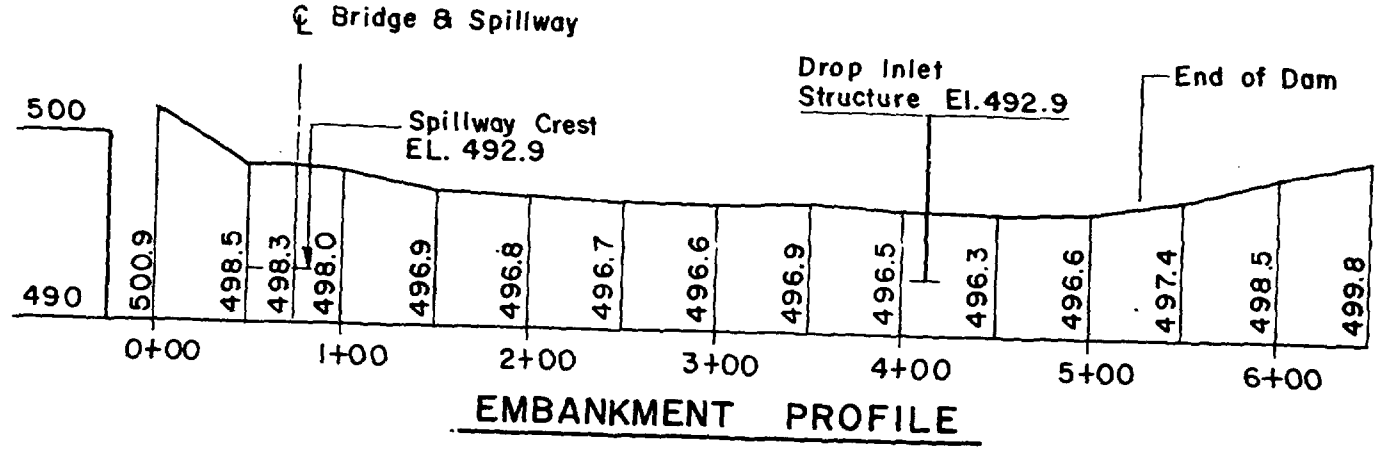


LAKE STRAUSE DAM
PA-01010
INSPECTION SURVEY

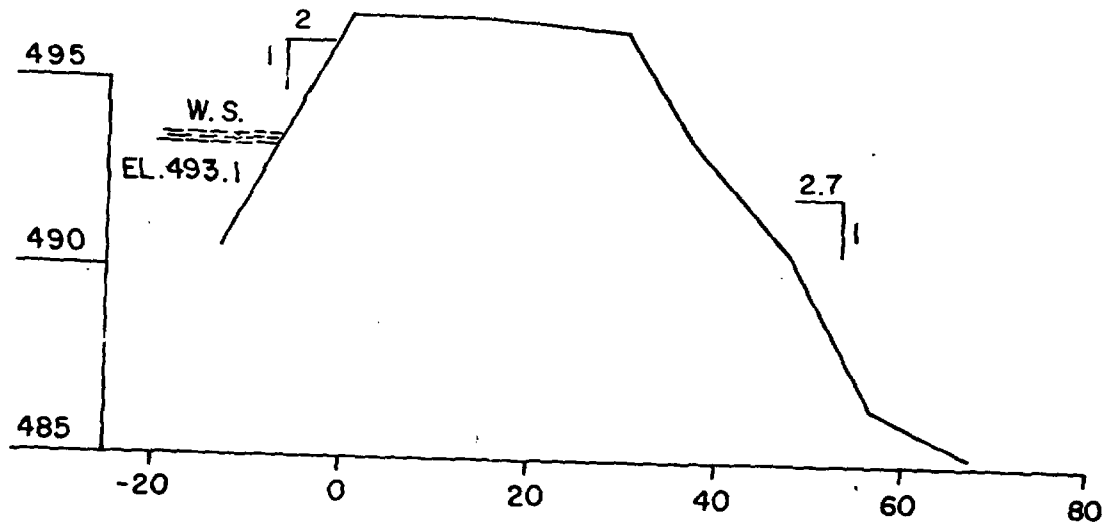
SURVEYED 6-15-81

PLATE A-I

SURVEYED 6-15-81

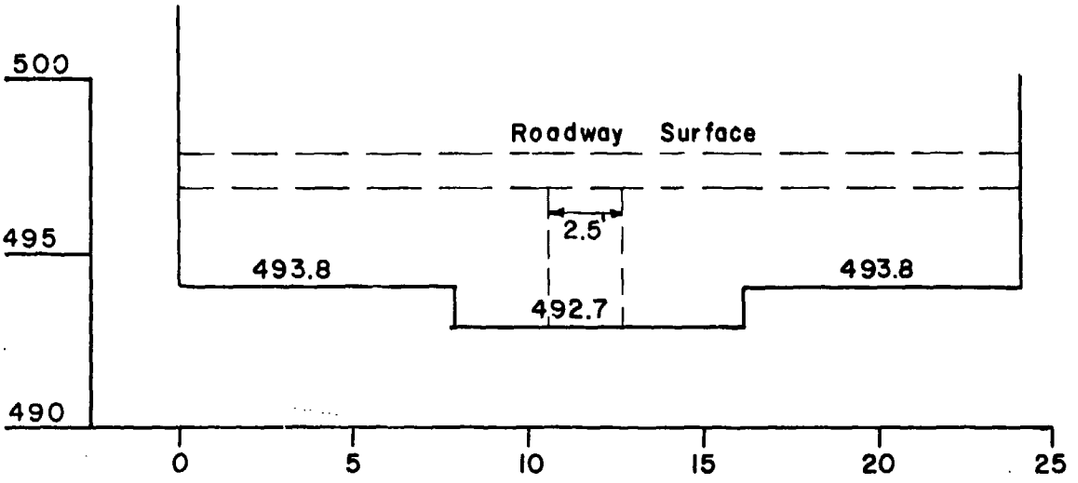


EMBANKMENT PROFILE

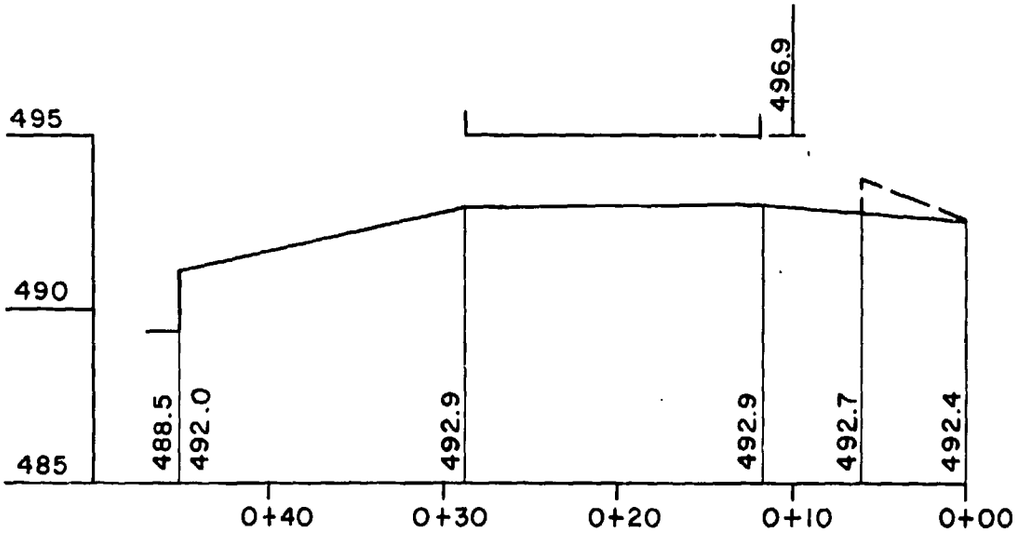


EMBANKMENT SECTION STA. 3+50

LAKE STRAUSE DAM
PA-01010
INSPECTION SURVEY
PLATE A-II



LOW FLOW DIVERSION



SPILLWAY CHANNEL PROFILE

LAKE STRAUSE DAM
PA-01010
INSPECTION SURVEY

SURVEYED 6-15-81

PLATE A-III

APPENDIX B

CHECK LIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 38-068 NDI NO. PA-01010

NAME OF DAM LAKE STRAUSE DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Fredericksburg, PA See Plate II, Appendix E
CONSTRUCTION HISTORY	Rebuilt in 1921 without a permit. First inspection in 1931. No records of changes made since that year.
GENERAL PLAN OF DAM	Not available.
TYPICAL SECTIONS OF DAM	Not available.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	None available.

NDI NO. PA-01010

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	No records.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	Inspection reports by PennDER.
BORROW SOURCES	Unknown.

NDI NO. PA-01010

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Many modifications, no records.
HIGH POOL RECORDS	Unknown.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	No records.
MAINTENANCE & OPERATION RECORDS	None.
SPILLWAY PLAN, SECTIONS AND DETAILS	None.

NDI NO. PA-01010

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	None.
CONSTRUCTION RECORDS	None.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Inspection reports by PennDER.
MISCELLANEOUS	

NDI NO. PA-01010

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Woodland

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 492.9 Acre-Feet 30

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 496.3 Acre-Feet 76

MAXIMUM DESIGN POOL: Elev. 496.3

TOP DAM: Elev. 496.3

SPILLWAY:	SOUTH	NORTH
a. Elevation	492.9	492.9
b. Type	concrete, broad crested weir	concrete drop inlet structure
c. Width	21.5'	4.5' x 3.7'
d. Length	--	--
e. Location Spillover	near left end of dam	upstream toe near right end of dam
f. Number and Type of Gates	none	none

OUTLET WORKS:

a. Type 3' orifice with slide gate

b. Location drop inlet structure

c. Entrance inverts 484.3

d. Exit inverts 484.0

e. Emergency drawdown facilities 3' square gate in drop inlet structure

HYDROMETEOROLOGICAL GAGES:

a. Type none

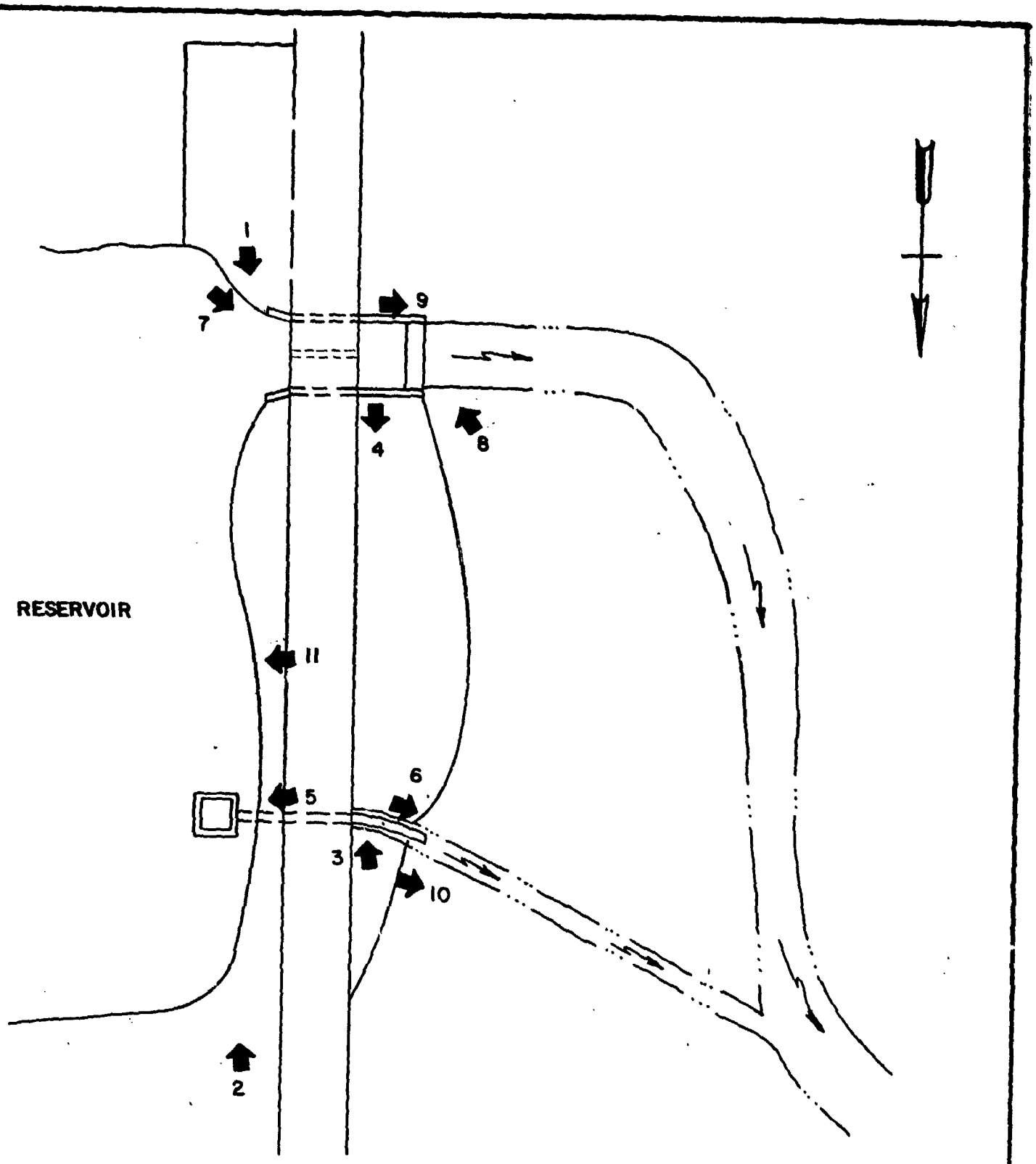
b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 474 cfs

APPENDIX C

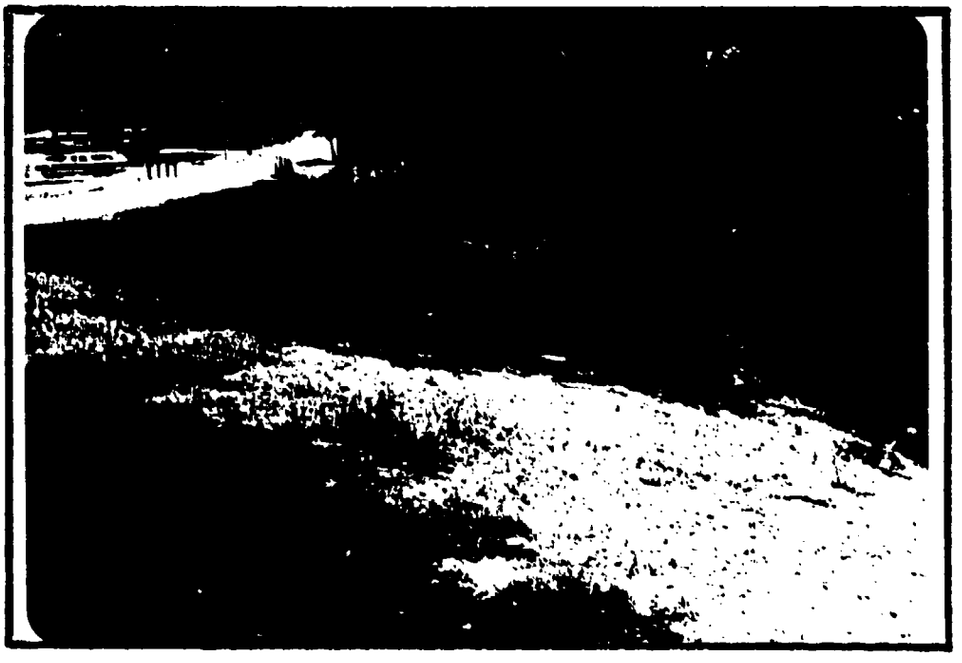
PHOTOGRAPHS



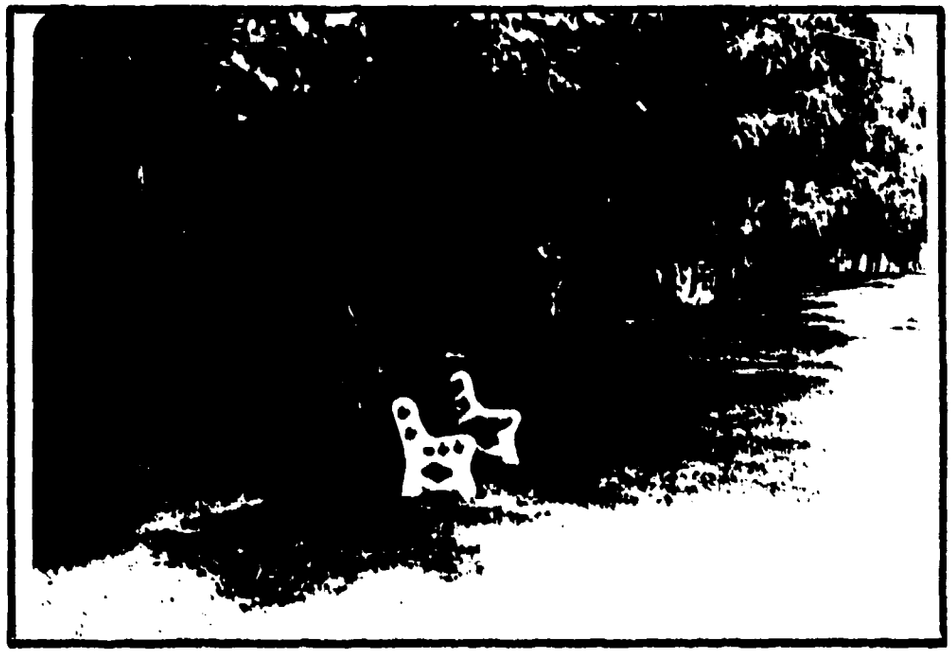
LAKE STRAUSE DAM
PA-01010
KEY MAP OF PHOTOGRAPHS

PLATE C-I

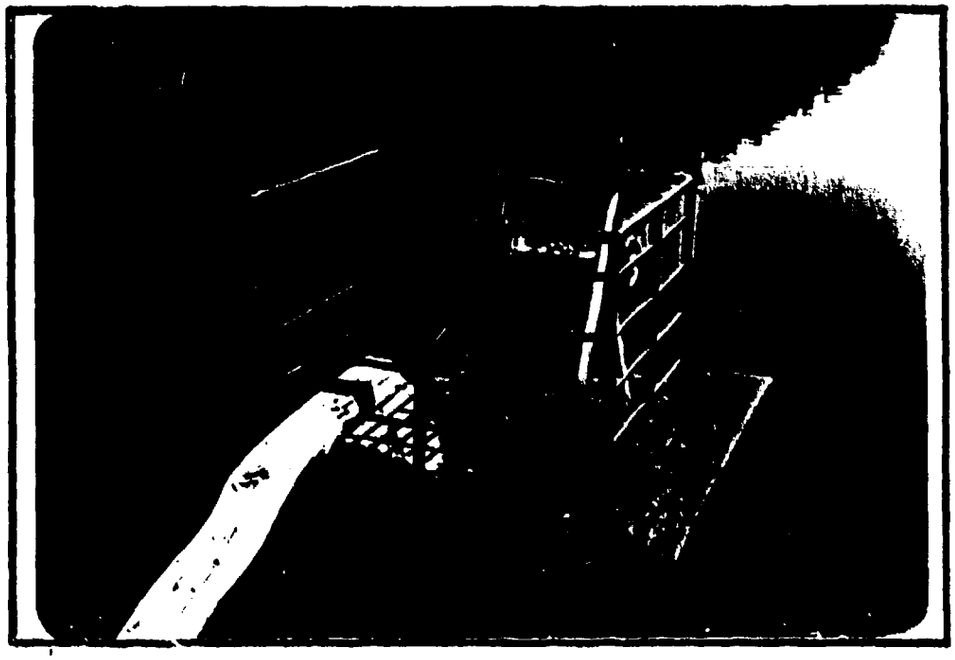
OVERVIEW FROM RIGHT ABUTMENT NO. - 2
DROP INLET IN FOREGROUND



OVERVIEW OF DOWNSTREAM SLOPE NO. - 3

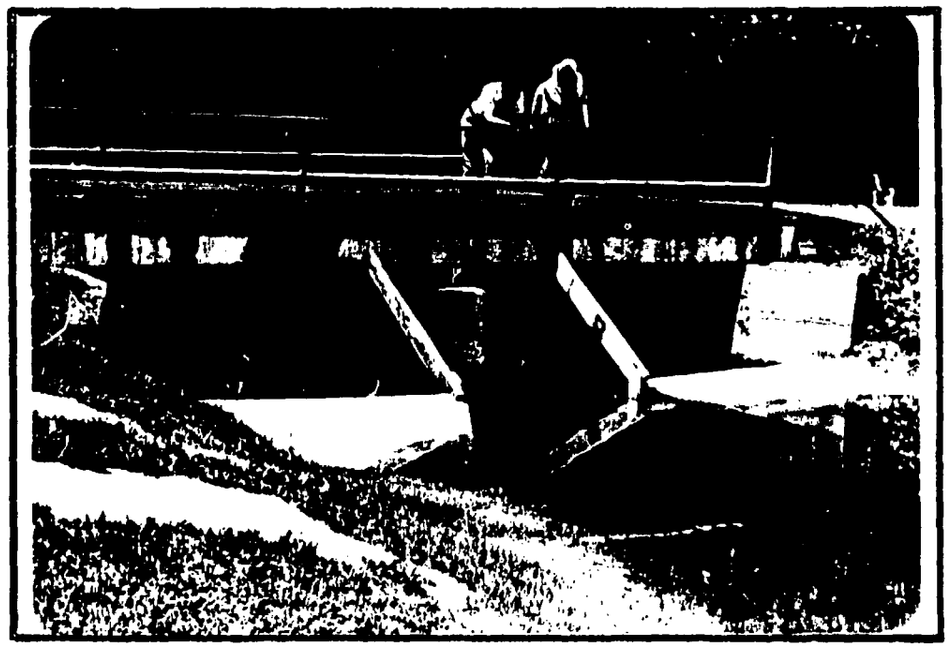


OVERVIEW OF DOWNSTREAM SLOPE NO. - 4



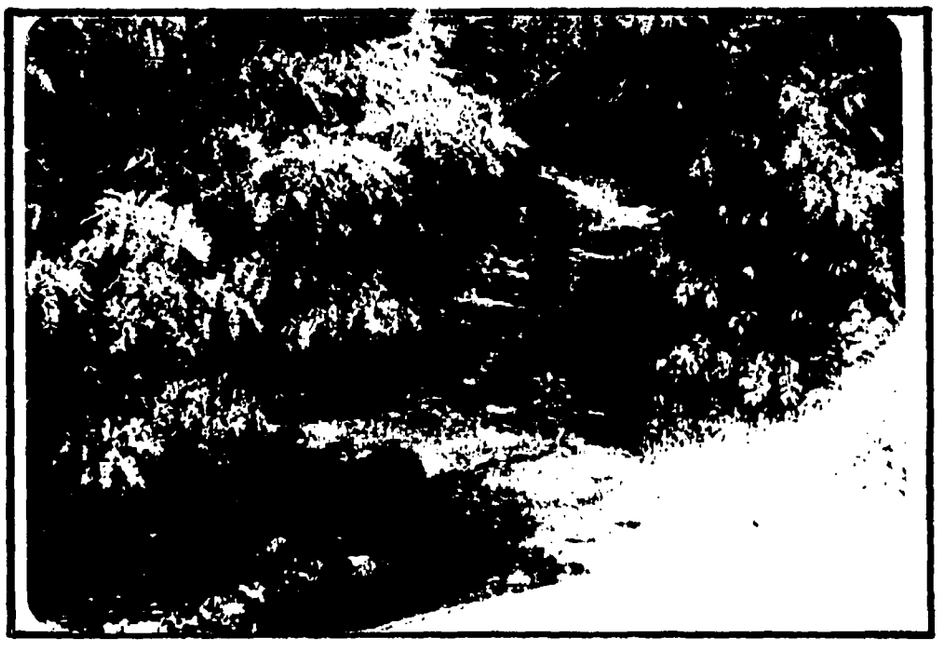
DROP INLET STRUCTURE NO. - 5

OUTLET OF DROP INLET STRUCTURE NO. - 6



WEIR OF SPILLWAY AND ROADWAY BRIDGE NO. - 7

DOWNSTREAM END OF SPILLWAY NO. - 8



DOWNSTREAM CHANNEL OF SPILLWAY NO. - 9

DOWNSTREAM CHANNEL NO. - 10

OVERVIEW OF RESERVOIR NO. - 11

PA-01010
Plate C-VI

APPENDIX D

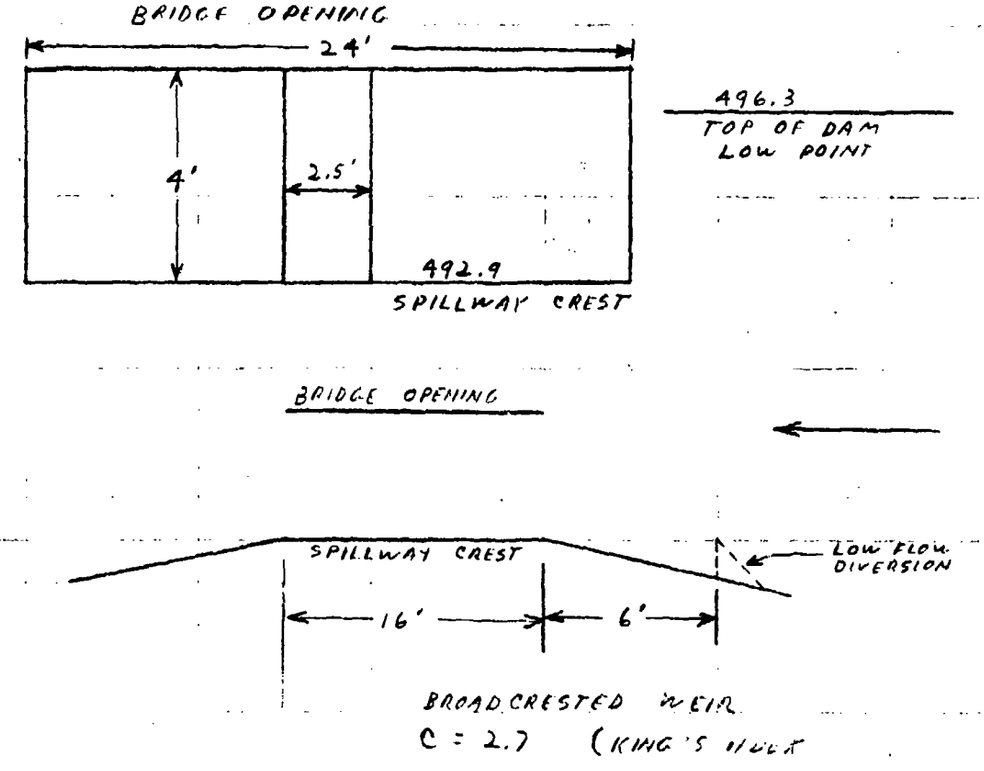
HYDROLOGY AND HYDRAULIC CALCULATIONS

BY RLS DATE 6/29/81 **BERGER ASSOCIATES** SHEET NO. 1 OF 7

CHKD. BY DATE PROJECT D0590

SUBJECT LAKE SYRACUSE DAM

SPILLWAY CAPACITY (SOUTH SPILLWAY)



$Q = C L H^{3/2}$

$H = 496.3 - 492.9 = 3.4'$

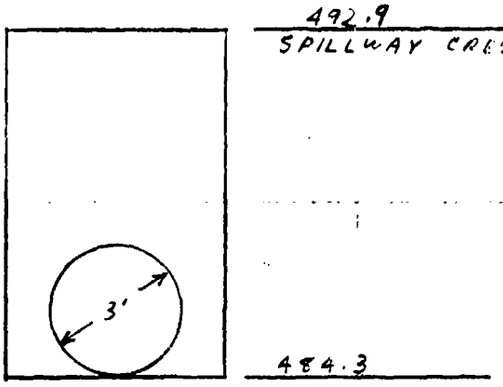
$L = 24 - 2.5 = 21.5'$

$Q = 2.7 \times 21.5 \times (3.4)^{1.5}$

$= 364$ CFS

SPILLWAY CAPACITY (NORTH SPILLWAY)

DROP INLET STRUCTURE



C = 0.6 (KING'S HDBK)

$Q = CA\sqrt{2gH}$

$H = 496.3 - 485.8 = 10.5'$

$Q = 0.6 \times \pi \times (3)^2/4 \times (2 \times 32.2 \times 10.5)^{0.5}$

$= 110$ CFS

STORAGE

30 AC-FT AT NORMAL POOL (EL. 492.9) (FROM PENNDER FILES)

PLANIMETERED AREAS (QUAD SHEET): ELEV. 492.9 = 10.4 A
ELEV. 500 = 23.6 A

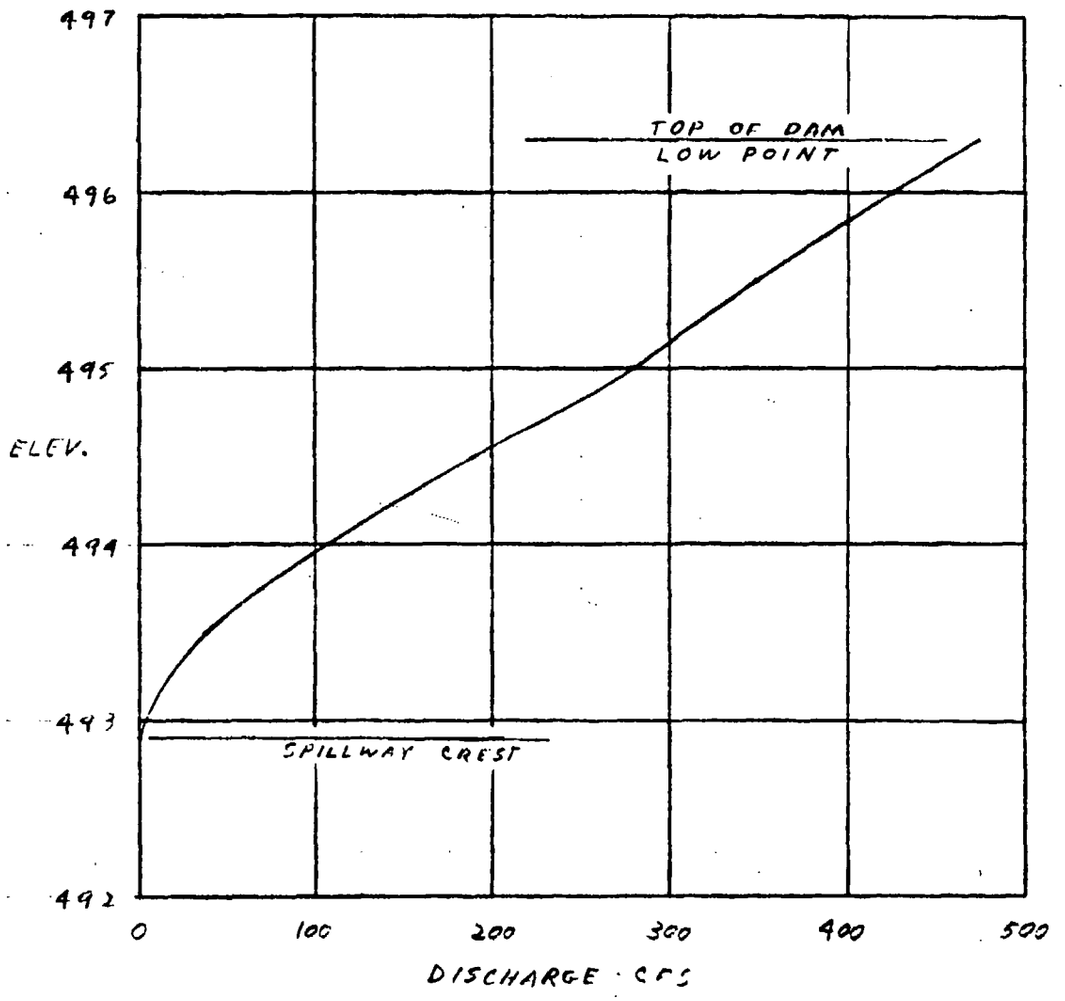
INTERPOLATED AREA: ELEV 496.3 = 16.7 A

$STORAGE = 30 + (h/3 (A_1 + A_2 + (A_1 \times A_2)^{0.5}))$

$= 30 + (3.4/3 (10.4 + 16.7 + (10.4 \times 16.7)^{0.5})) = 76$ AC-FT

BY RLS DATE 6/29/81 **BERGER ASSOCIATES** SHEET NO. 3 OF 7
CHKD. BY DATE PROJECT 00590
SUBJECT LAKE STRAUSE DAM

DISCHARGE CAPACITY CURVE



BY RLS DATE 6/30/81 | BERGER ASSOCIATES | SHEET NO. 1 OF 7
CHKD. BY DATE | PROJECT 00590
SUBJECT LAKE STRAUSE DAM

DISCHARGE THROUGH OUTLET WORKS

3' DIAMETER ORIFICE $C = 0.6$ (KING'S HDBK)

INVERT ELEV. = 484.3

$Q = CA\sqrt{2gH}$

AT POOL ELEV. 492.9

$H = 492.9 - 485.8 = 7.1'$

$Q = 0.6 \times \pi \times (3)^2/4 \times (2 \times 32.2 \times 7.1)^{0.5}$

$= 91$ CFS

AT LOW POOL ELEV. 488

$H = 488 - 485.8 = 2.2'$

$Q = 0.6 \times \pi \times (3)^2/4 \times (2 \times 32.2 \times 2.2)^{0.5}$

$= 50$ CFS

BY RLS DATE 6/29/81 BERGER ASSOCIATES SHEET NO. 5 OF 7
CHKD. BY DATE PROJECT 00590
SUBJECT LAKE STRAUSE DAM

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF FLOOD LEVELS AT LAKE STRAUSE. BASED ON RECORDS OF THE U.S.G.S STREAM GAGING STATION ON REEDS CREEK AT NEARBY ONO, PA. (DA. = 8.63 SQ MI.) THE MAXIMUM RECORDED FLOW OCCURRED IN 1975 WHEN A FLOW OF 2840 CFS WAS OBSERVED. THE MAXIMUM FLOW INTO LAKE STRAUSE IS ESTIMATED TO BE:

$$\left(\frac{3.07}{8.63}\right)^{0.8} \times 2840 = 1242 \text{ CFS}$$

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM HEIGHT = 19 FEET
MAXIMUM STORAGE = 76 ACRE-FEET
SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION

RESERVOIR AND DAM LOCATED A SHORT DISTANCE DOWNSTREAM.
USE "SIGNIFICANT"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE 100 YEAR FLOOD TO ONE HALF THE PROBABLE MAXIMUM FLOOD.

BY RLS DATE 6/30/81 BERGER ASSOCIATES SHEET NO. 6 OF 7
CHKD. BY DATE PROJECT D0590
SUBJECT LAKE SIPAUSE DAM

100 YEAR FLOOD

REF: "HYDROLOGIC STUDY, TROPICAL STORM AGNES"
NORTH ATLANTIC DIVISION, U.S. ARMY, CORPS OF ENGINEERS.

DRAINAGE AREA = 3.07 SQ. MI.

(FIG. 21) $C_m = 1.98$

$\text{LOG}(Q_m) = C_m + .75\ \text{LOG}(DA)$

$= 1.98 + .75\ \text{LOG}(3.07) = 2.345$

(FIG. 22) $C_s = .4$

$S = C_s - 0.05\ \text{LOG}(DA)$

$= .4 - 0.05\ \text{LOG}(3.07) = .376$

(FIG. 23) SKEW (g) = .41

STANDARD DEVIATE = $K(P,g) = 2.6224$

$\text{LOG}(Q(P)) = \text{LOG}(Q_m) + K(P,g)S$

$\text{LOG}(Q_1) = 2.345 + (2.6224 \times .376)$

$= 3.331$

$Q_1 = 2143$ CFS

BY RLS DATE 6/30/91 **BERGER ASSOCIATES** SHEET NO. 7 OF 7
CHKD. BY DATE PROJECT D0590
SUBJECT LAKE SIRAUSE DAM

100 YR FLOOD (CONT.)

REF. WATER RESOURCES BULLETIN NO. 13, "FLOODS IN PENNSYLVANIA", PA. DEPT. OF ENVIRONMENTAL RESOURCES AND U.S. GEOLOGICAL SURVEY.

DRAINAGE AREA = 3.07 SQ. MI.

(PLATE 1) MODEL = 5

PRECIPITATION INDEX
(PLATE 2) RAINFALL = 46.2"
(PLATE 2) EVAPOTRANSPIRATION = 26.7"

P_i = 46.1" - 26.7" = 19.4"

$$Q_T = C A^x P_i^p$$

C = 42.2
x = .751
p = .744

$$Q_{100} = 42.2 \times (3.07)^{.751} \times (19.4)^{.744}$$

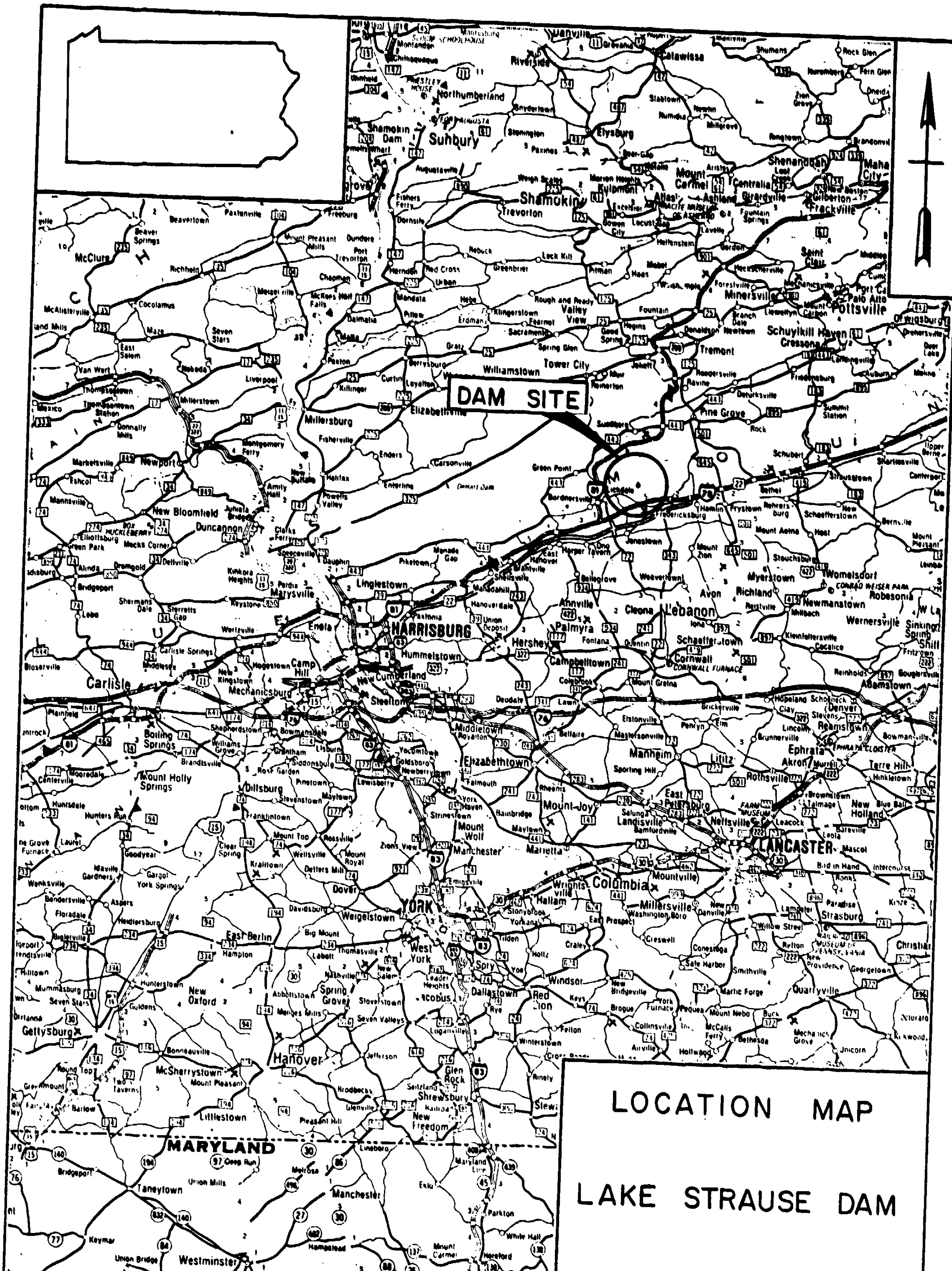
= 890 CFS

APPROXIMATE 100 YR. DISCHARGE

(2143 + 890)/2 = 1517 CFS

APPENDIX E

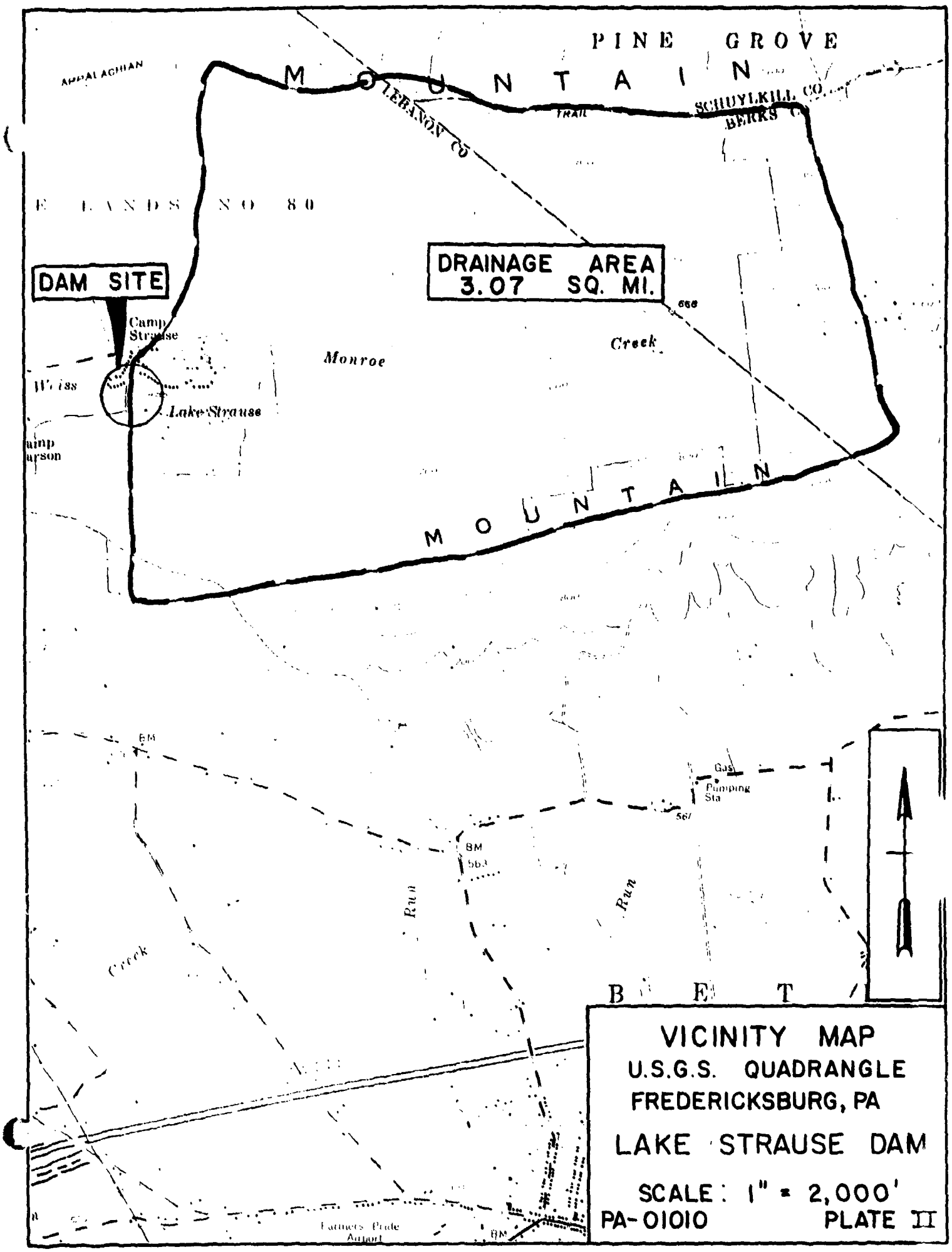
PLATES



LOCATION MAP

LAKE STRAUSE DAM

PA-01010 PLATE I


PINE GROVE
MOUNTAIN
APPALACHIAN
TRAIL
LEBANON CO
SCHUYLKILL CO.
BERKS C
E LANDS NO 80
DAM SITE
DRAINAGE AREA
3.07 SQ. MI.
Camp
Strause
Monroe
Creek
Weiss
Lake Strause
MOUNTAIN
BM
Gas
Pumping
Sta
567
BM
563
Run
Run
Creek
Farmers Pride
Airport
BM
B E T
VICINITY MAP
U.S.G.S. QUADRANGLE
FREDERICKSBURG, PA
LAKE STRAUSE DAM
SCALE: 1" = 2,000'
PA-01010
PLATE II

APPENDIX F

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

The dam and reservoir are found within a Lower Ordovician age member of the Hamburg Sequence. This member consists of brown or gray calcareous graywacke interbedded with gray shale and slate, quartzite, conglomerant and minor beds of limestone. Some 1,000 feet (0.30 KM) to the north of the reservoir is the apparent contact between the Hamburg Sequence and the Martinsburg Formation.

Structure

There are no apparent major structural features in the vicinity of the dam and reservoir, except for the Hamburg-Martinsburg contact. This contact should have little effect on the localized geology. Due to the interbedded nature of the unit and the occurrence of limestone, there is a possibility of subsurface seepage, but its extent is dependent on the localized lithology.

Overburden

There are three major soil types located in the immediate vicinity of the dam and reservoir. To the west of the dam lies the Atkins silt loam which is alluvial in origin. To the north of the dam and reservoir lies the Berks shaly loam. This is predominantly a residual soil resulting from the weathering of the parent bedrock. The third soil type lies to the south of the dam and reservoir and is the Buchanan very stony loam. This soil is colluvial in origin.

Aquifer Characteristics

According to available information, this member of the Hamburg Sequence should be a reasonably good aquifer. Median yeilds from non-domestic wells in adjacent Berks County are 75 gallons per minute and domestic wells yield 20 gallons per minute. With this in mind, there is the possibility of subsurface seepage, but like the well yields, it may vary depending on localized lithology.

Discussion

This member of the Hamburg Sequence seems to provide a reasonable foundation for heavy structures, provided it is excavated to sound material. According to a personal memorandum, the owner maintained that the dam core foundation was taken to a solid foundation. If so, subsurface seepage should be minimal, but still possible due to the aquifer's lithologic characteristics.

Sources of Information

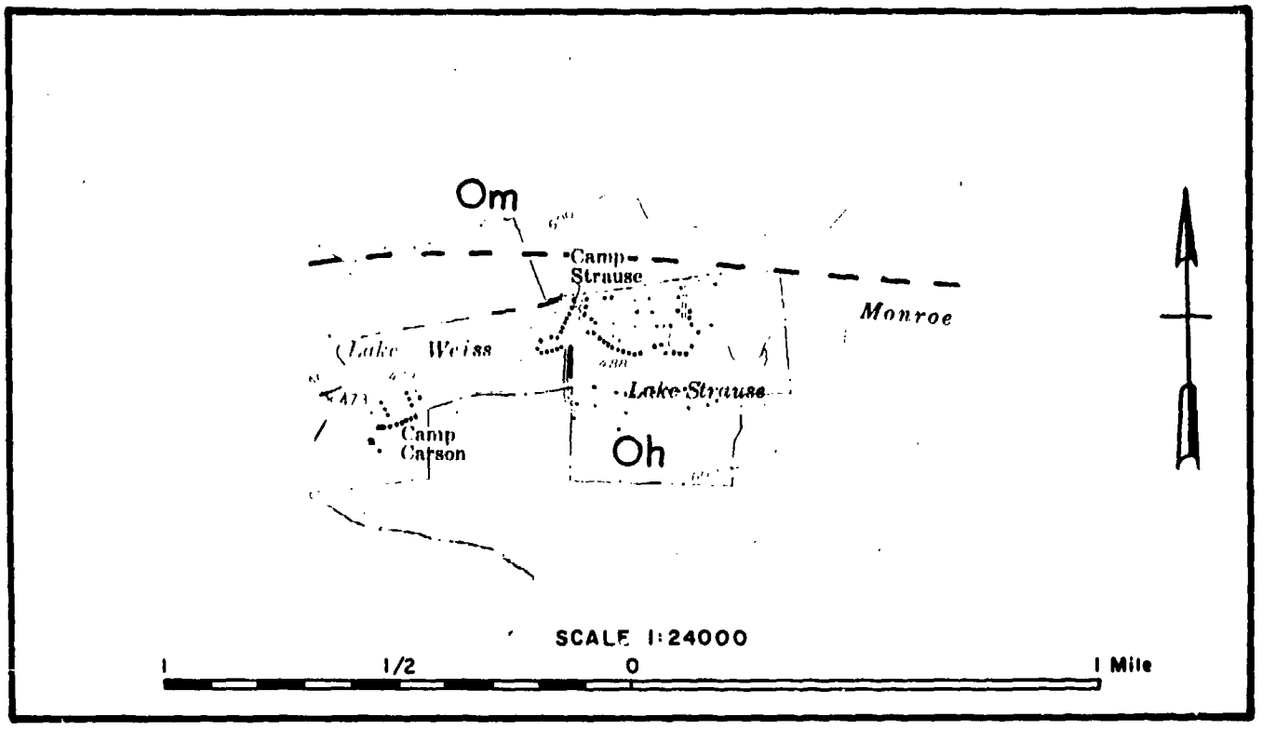
1. McGlade, W.G., et al., 1972. Engineering Characteristics of the Rocks of Pennsylvania, Pennsylvania Geological Survey EG-1.

2. Pennsylvania Geological Map Worksheet - Fredericksburg Quadrangle, 1980. Pennsylvania Geological Survey.

3. Soils Survey - Lebanon County Interim Report, 1980. Soil Conservation Service, U.S.D.A.

4. Wood, C.R., D.B. MacLachlan, 1978. Geology and Groundwater Resources of Northern Berks County, Pennsylvania Geological Survey.

GEOLOGICAL MAP - LAKE STRAUSE DAM



LEGEND

Oh	Hamburg Sequence
Om	Martinsburg Form
- - -	Approximate Contact